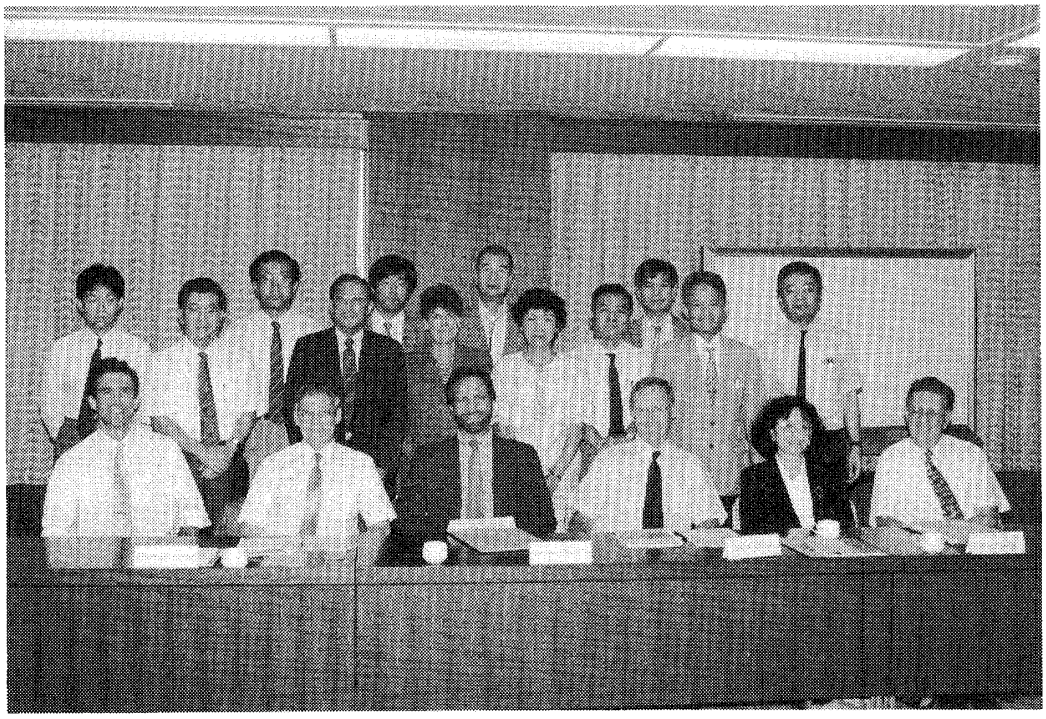
第12章　David R. Olson 教授らを囲む拡大研究会報告



平成元年 8 月25日：Olson 教授を囲む拡大研究会参加者

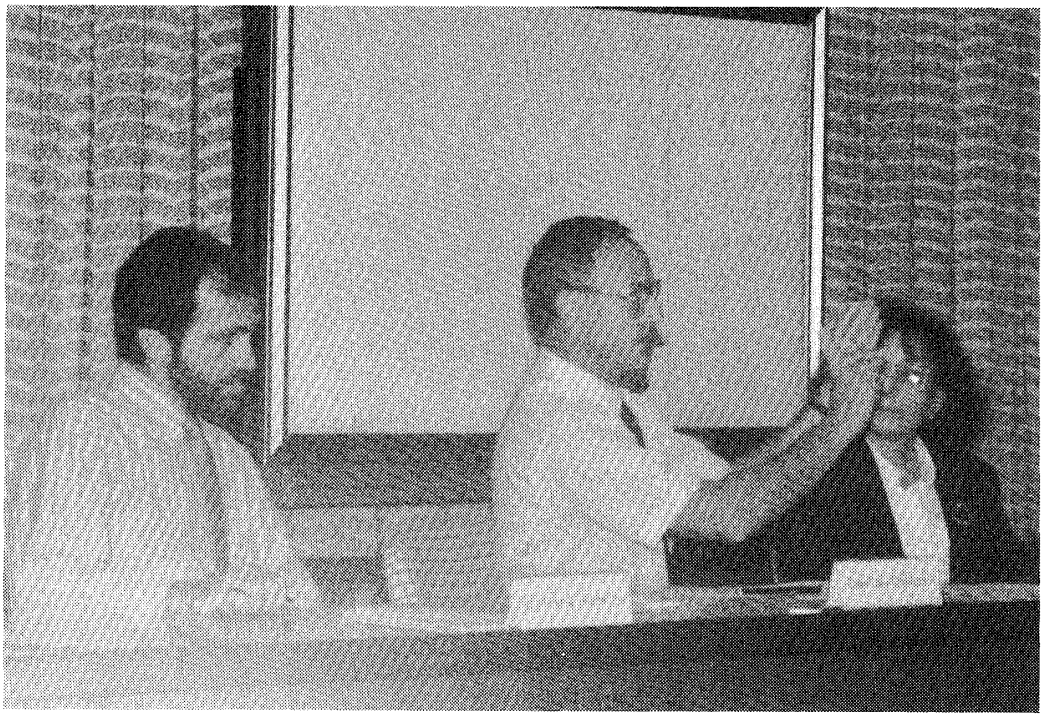
Olson教授らを囲む拡大研究会報告

1989年8月25日に、Olson教授を始めとして5名の外国人研究者達の訪問を受けた。この際、われわれの研究を紹介し、指導助言をうけるためのシンポジウムを開くことが出来た。この特別な企画は大阪大学の水越敏行教授のお計らいによって実現したもので、当年は大阪大学創立50周年記念のニューメディア関連国際シンポジウムに招待された国際的に著名な学者が日本に集まったまたとない機会であった。

所内においては、加藤秀俊所長のご配慮もあって、われわれのプロジェクトの拡大研究会という形で、このシンポジウムを開くことが出来た。この研究会に司会として参加された佐賀啓男助教授、「ハイパー・メディアによる学習」を発表していただいた浜野保樹助教授のご協力を深く感謝するものである。ここでは、本プロジェクトに関連のある3論文だけを報告した。

発表の後で自由な討論が行なわれたが、いずれも、われわれの映像に対する新しい実験的アプローチに対しては強い関心と興味が示された。具体的な方法論に関する助言もあり、収穫の多い充実した研究会となった。発表や討論の過程はすべて録音されており、各自の分担で現在テープ起こしの作業が進んでいる。いずれ、何らかの形で刊行したいと考えている。

（藤田恵璽）



研究報告に対してコメントするOlson教授：拡大研究会にて

Human Cognitive Processes and Newer Information Media

標記研究会を平成元年８月２５日（金）１３時から研究図書資料棟２階小会議室で開きます。関心をおもちの方はどなたでも御参加ください。
（外国からの訪問参加者）
Olson, D.R. (The Ontario Inst. for Studies in Education, Canada)
Davydov, V.V. (Inst. of Preschool Education, USSR)
Clements, M. (New York Univ., USA)
Earnshaw, J.B. (Lancashire County Council, UK)
Fasano, C. (Univ. of Wollongong, Australia)
Burton, R.R. (Trio Software Systems, Inc., USA)

タクソノミー研究班拡大研究会
世話人・伊藤2329／佐賀2307

August 25, 1989

National Institute of Multimedia Education

Japan

Human Cognitive Processes and Newer Information Media

Programme

August 25 1989 13:00 - 15: 30

National Institute of Multimedia Education

Chairperson: Hiroo Saga

13: 00	Welcome	Keiji Fujita
13: 10	Learning with Hypermedia	Yasuki Hamano
13: 25	Comment	Visitors
13: 35	An Analysis of Eye Movements while Watching Educational TV Programs	Hideko Itoh
13: 50	Comment	Visitors
14: 00	Approaches to Learning and Abstraction of Information from Video	Mavis Kelly
14: 15	Comment	Visitors
14: 25	Afternoon tea	
14: 35	AV-testing, Interest and Attention	Keiji Fujita
14: 50	Comment	Visitors
15: 00	Plenary Discussion	
15: 30	Close	

An Analysis of Eye Movements while Watching Educational TV Programs

Hideko Itoh
National Institute of Multimedia Education

Recent advances in media technology and its increased diffusion have changed our learning environments. We can get so much information without direct experience that our understanding of the world is very much media-dependent. Basic study of human cognitive processes while learning from media is one of the important topics in the field of education.

Educational TV programs present visual and/or auditory information, and yet we do not know precisely what we are actually learning through sight and hearing. Study of the interaction between senders and receivers of information is necessary: for the former, analysis of the structure of educational programs, for the latter, how it is processed and acquired.

An analysis of eye movements while watching educational TV programs is one of the methodologies for studying audiovisual information processing. Combined with the results of recall tests, cognitive learning processes can be examined. Moreover, these findings will be useful in improving TV programs.

The aims of this study are:

1. To characterize individual scanning patterns during the observation of educational TV programs,

2. To explore analytical methods for determining patterns of visual information processing,

3. To examine the effects of visual and auditory presentation in the programs,

4. To provide information for production of effective educational programs.

Experiment I

Method

University student subjects, wearing an eye camera, watched sample videotapes edited from TV programs of the University of the Air. The programs were presented in each of the following three viewing conditions:

* In Condition AV1, pictures with sound were presented.

* In Condition V-AV2, pictures without sound were followed by pictures with sound.

* In Condition A-AV2, sound without pictures was followed by pictures with sound.

After watching the program, the subjects were asked to answer questions concerning what they saw, heard, felt and thought.

Results and discussion

Various patterns of eye movements corresponding to various scenes of the programs were revealed by the analytical method, and those findings enabled us to characterize individual scanning behaviors during the observation of educational TV programs.

Fixation points: Analyses of scanpaths and distributions of fixation times indicated that most viewers paid attention to:

1. The human face
2. The caption
3. Moving objects in the pictures.

All of these are important sources of information.

Comparison of eye movements under conditions AV1, V-AV2 and A-AV2: Eye movement patterns were similar in conditions AV1, V, and AV2.

Individual differences in eye movements: The eye movements during graphic presentations indicated greater individual differences. Although their ways of viewing were different, the subjects correctly responded to the questions concerning the important points. It should also be noted that they had already learned the key concepts under V condition where pictures were presented without sound.

These findings imply that "pictures are as eloquent as sound", which can be applied to improve production procedures for educational programs. That is, presenting these kinds of pictures with minimum explanation stimulates the viewers to learn by themselves through this medium.

Experiment II

Method

Subjects were university students. Instructional materials were two sample videotapes, A and B, edited from TV programs of the University of the Air, each of which consisted of five scenes. The programs were presented in the following viewing conditions:

Scene 1	Auditory presentation with pictures (Ap)	vs	Auditory presentation (A)
Scene 2	Visual presentation (V)	vs	Visual presentation with narration (Vn)
Scene 3	Audiovisual presentation with narration (AVn)	vs	Audiovisual presentation (AV)
Scene 4	Auditory presentation (A)	vs	Auditory presentation with pictures and captions (Apl)
Scene 5	Computer graphics (Vcg)	vs	Still pictures (Vst)

Results and discussion

Recall and eye movements: The viewers' responses were analyzed in terms of whether or not they fixated (E, $\overline{E}$) on the points related to the items in the recall test (excluding auditory presentation items), and whether the answer to recall items was correct or incorrect (R, $\overline{R}$). Cross tabulation of these two measures revealed only ER and E$\overline{R}$ patterns, which means that all subjects scanned the pictures. More detailed analyses will be necessary for the E$\overline{R}$ pattern in connection with the amount of fixation and types of incorrect responses, for example, partial reproduction, no answer.

Order and Medium of Information Presentation and Eye Movements: The orders of presentation of pictures and sound/narration, and eye fixations were examined for the items related to Scenes 1 and 2. In most cases, pictures were presented prior to sound/narration, and eye fixations tracked the picture before sound/narration occurred. The programs are constructed so that pictures first call one's attention, then verbal information is added. Human eye movements also corresponded to movements of the "camera eye".

Eye movements on computer graphics and still pictures: Comparison of eye movements on computer graphics and still pictures of the same figures revealed that computer graphics guided viewers' eye movements, whereas there were greater individual differences in scanpaths on still pictures. These findings are similar to the results of Experiment I and those on the order and medium of information presentation mentioned above.

The significance of the methodology of this research should be discussed to characterize cognitive processes while learning from audiovisual media.

Approaches to Learning and Abstraction of Information from Video

Mavis Kelly
National Institute of Multimedia Education

Introduction

Use of audiovisual materials is increasingly commonplace in tertiary education. For psychologists the interesting questions are what cognitive processes are involved in learning from audiovisual materials and for instructional designers, how specific program features can enhance learning. There is another dimension to the question, however, and that is how the approaches that learners adopt influence the type of information they abstract and the level of processing that they engage in while viewing or listening to complex audiovisual materials such as video or television. This is the issue that is addressed here.

The research is based on theoretical and methodological perspectives of Ference Marton and his co-workers at the University of Goteborg in Sweden. Basically these researchers have attempted to understand and classify learning orientations (meaning and reproducing) among tertiary students and to relate these orientations to levels of learning outcome which are assessed qualitatively in terms of the degree to which they reflect understanding of the author's intention, when reading complex textual material. Related research by Biggs in Australia and the Lancaster group in Britain also influenced our research. So far this type of research has focussed on textual material, but in order to inform educational practice more broadly, we need to explore the utility of the concepts using a wider range of materials, in particular audiovisual materials and computer-based learning materials.

Aims

In this project, we aimed to conduct a preliminary study on learning from video with Japanese university students, taking into account their self-reported approaches to learning. We also aimed to explore the construction of a test instrument which would enable us to assess both factual recall of information and level of comprehension of the video's content.

Method

Participants: Thirty second and third year students from faculties of science and horticulture at Chiba University took part in the research. The group consisted of 17 males and 13 females. These students had previously taken part in a larger survey on approaches to learning among Japanese university students using the Lancaster Approaches to Study Inventory so we were able to assess their self-reported approaches to university study in general, in terms of meaning and reproducing orientations. Students viewed the video as a group and took the test in a single session.

Video: The video chosen was a British Open University film, entitled *Creating the System*, which deals with the topic of Artificial Intelligence. A Japanese language version of this video was available. Before using the video and before designing the test instrument, the video was subjected to detailed analysis both in terms of a scene by scene description of the content and development of a model showing the hierarchical relationship between the concepts that were being taught. We argue that in order for students to understand the meaning of the video they need to understand that some items of information are superordinate to others. This is particularly true in videos such as this and many other Open University videos where examples or demonstrations to illustrate the main points are used throughout. In outline the video used in this experiment had the following structure:

Development of Artificial Intelligence

Contribution of Psychologists	Contribution of Computer Scientist
Understanding complex human behaviour	Construction of computer programs to simulate human behaviour
Demonstration of work of psychologists	Demonstration of work of Computer Scientists
* observation of human performance * models of information processing * flow chart construction	* database construction * construction of robots * flow chart construction

Test: For this preliminary experiment a pencil and paper test was used to assess learning outcomes. The video was divided into four segments and a number of questions were asked after each segment was shown. In total there were 34 questions. Questions were presented in a booklet with black and white stills from the video used as aids to questioning and as contextual cues.

Factual learning questions (N=13) asked for information about what was actually said or done in the video. For example: "What did this man say his job was?"

Comprehension learning questions (N=10) were of two types, those which required an inference to be made from the factual content of the video (N=6) and those which attempted to tap more general understanding of the the higher order message of the video (N=4). An example of the inference questions would be: "What would the robot have done if there had been two strips of light on the floor instead of three?". An example of the second type would be: "Why do you think these two men appeared together in the video?".

Incidental learning questions (N=11) asked for details which had no direct connection with the content or meaning of the video. They were included to ensure close attention to the video throughout. For example: "How many times does the robot turn in the maze?"

In addition the question "What is artificial Intelligence?" was asked before the video commenced, in the middle testing session and in the final testing session, after the whole video had been screened. We aimed to analyze responses to this question in terms of ongoing development of the concept.

Results

Incidental learning and factual learning responses were scored on a correct/incorrect basis. Comprehension learning items of both types required multi-level scoring. Clearly the first test session cued the participants as to what to look for in the remaining parts of the video. Performance in incidental learning and factual learning increased sharply in the second and subsequent sessions.

Analysis of the comprehension learning items has not yet been completed. Clearly the most interesting aspect of this analysis is to what extent participants who report a high meaning orientation to study in general differ from those who report themselves to be high on a reproducing orientation.

Our results will also be compared with the basic findings of other researchers using textual materials. If the pattern of responding is similar in both media, we would expect to find that participants who have a high meaning orientation will perform as well as those with a high reproducing orientation when cued to attend to factual recall. However, they should outperform participants with a high reproducing orientation when cued to attend to comprehension questions.

AV-testing, Interest and Attention

Keiji Fujita
National Institute of Multimedia Education

The way that students learn from auditory and/or visual presentation has been studied. An audiovisual test has been developed in order to assess how viewers obtain and process information conveyed in various modes of presentation.

Discrepancy of recall between auditory and visual presentation

A short scene of a science video depicting cell activities of freshwater green algae was shown to two groups of university students (non-science major). To one group the video was shown without sound, and to the other without picture. The students of both groups were asked to describe the program, immediately after the presentation. Key words such as nucleus, chloroplast, and conjugation appeared in 20-40% of the auditory group, whereas they appeared only in 0-4% of the visual group. This is one example of how students often know only words without knowing their referents. It is always more difficult for the audience to describe a silent video than to recall the narration going with the picture. Those who are able to explain things verbally can not always cope with real situational problems or visually presented tasks.

Recall test scores and interest

After viewing a 45 minute lecture program of the University of the Air, students were asked the part in which they were most interested. And they were also asked to recall minor points shown in the picture and mentioned by the persons appeared in the video. Those points can not be answered correctly unless one actually watches the very program carefully, although they are trifles. The average percentage of correct recall was always highest in the most interested scenes of the program. The points they were asked to recall were too minor to demand attention , but the fact that they recalled them successfully indicates that they can obtain more information unintentionally from interesting parts than from uninteresting ones.

Peer identity and attention

People usually pay more attention to their peer group's activity in the video. For example, a group of school teachers who were undertaking in-service training in a graduate school of education indicated a strong attention to a music teacher appearing in the test video. They showed the highest recall percentage on items relating to the teacher's appearance. The percentage of correct recall on the items relating to what the music teacher said was on average 83%, while the average recall percentage on the items relating to what other instructors mentioned was 39%. Another test administered to elementary school children also indicated that girls look at girl's activities more often than boy's activities, and vice versa, when presented to a slide picture in which a boy and a girl are playing in a similar fashion.

Evaluation of programs and recall score

Among the low scorers (less than the average score, of the recall test), there was a positive correlation (r=0.74) between program evaluation scores and recall scores, whereas the high scorers tended to evaluate the program almost independently of their recall scores (r=-0.06). This indicates that a negative attitude toward the program may sometimes prevent the audience from gaining information from the program. Parts of the video which they evaluated to be easy to follow usually yielded high percentage of recall on the items related to the scenes.